USAWC STRATEGY RESEARCH PROJECT

AMERICA'S ENERGY SECURITY POLICY: GOALS FOR 2025

by

Lieutenant Colonel Gary D. Chesley
United States Air Force

Dr. Janeen Klinger
Project Adviser

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 MAR 2007	**Strategy Research Project**	**00-00-2006 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
America's Energy Security Policy Goals for 2025	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Gary Chesley	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army War College,Carlisle Barracks,Carlisle,PA,17013-5050	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
See attached.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**24**	

ABSTRACT

AUTHOR: Lieutenant Colonel Gary D. Chesley

TITLE: America's Energy Security Policy: Goals for 2025

FORMAT: Strategy Research Project

DATE: 1 February 2007 WORD COUNT: 5,914 PAGES: 24

KEY TERMS: Oil, Renewable Fuel, Middle East

CLASSIFICATION: Unclassified

President Bush declared in his 2006 State of the Union address that "America is addicted to oil, which is often imported from unstable parts of the world." He set a goal to replace more than 75 percent of the oil imported from the Middle East by 2025. However, nearly every recent president since the Nixon administration has had energy goals; few have been achieved. This paper assesses the failure to meet past energy goals, analyzes energy trends, and recommends actions to meet the goal of replacing 75 percent of Middle East imported oil by 2025.

AMERICA'S ENERGY SECURITY POLICY: GOALS FOR 2025

No problem was ever solved by using the same consciousness that created it.

—Albert Einstein[1]

President Bush declared in his 2006 State of the Union address that "America is addicted to oil, which is often imported from unstable parts of the world." He set a goal "to replace more than 75 percent of our oil imports from the Middle East by 2025."[2] This ambitious energy security goal follows those of nearly every administration since President Nixon. However, few of those goals have ever been met. This failed policy pattern seems rooted in a tendency to conserve energy with only existing oil and gasoline systems—the same oil addicted systems that have created foreign oil dependence. Radically new policies and technologies should be implemented using a different "consciousness" to solve national energy security challenges.

This paper (1) assesses the failure to meet past energy goals, (2) analyzes energy trends, and (3) recommends actions to meet the goal of replacing 75 percent of Middle East imported oil by 2025.

National Energy Goals and Performance

During the 1973 Arab oil embargo[3], President Nixon unveiled Project Independence, claiming, "In the last third of this century, our independence will depend on maintaining and achieving self-sufficiency in energy." He proclaimed, "What I have called Project Independence in 1980 is …set to ensure that by the end of this decade, Americans will not have to rely on any source of energy beyond our own."[4] The objective was not achieved. Richard Rosecrance observed in his book, *The Rise of the Trading State: Commerce and Conquest in the Modern World*, "that the United States imported the same 36 to 37 percent of its oil needs in 1980 as it had in 1973."[5]

With the Energy Policy and Conservation Act of 1975, President Gerald Ford set federal standards for energy efficiency in new cars for the first time.[6] Although the average American made auto reached nearly 25 miles per gallon (mpg) by 1983, President Bush's proposed standard for light trucks and sport utility vehicles in 2007 only strives for 22.2 mpg[7]—hardly a leap forward in vehicle efficiency.

In 1977 President Jimmy Carter declared energy independence an issue of such vital national interest, stating that it was the "moral equivalent of war." He created the U.S. Department of Energy to manage the nation's energy matters. In 1979 after the Iranian oil crisis doubled oil prices, President Carter vowed, "Beginning this moment, this nation will never use

more oil than we did in 1977—never."[8] Unfortunately, today Americans import almost twice as much oil. The 36 to 37 percent imported in 1973 has risen to 60 percent today.[9]

In 1991, President George H. W. Bush announced a national energy strategy aimed at "reducing our dependence on foreign oil." He funded the U.S. Advanced Battery Consortium, a $260 million research effort to develop lightweight battery systems for electric vehicles.[10] However, there are no wholly electric cars on the American market today.

President Bill Clinton proposed a large tax on crude oil in 1992 to discourage dependence on foreign oil.[11] However, consumption has risen from 17.3 million barrels per day in 1973 to 20.6 million barrels per day in 2006.[12] In 1993, President Clinton launched a billion dollar Partnership for New Generation Vehicles with the big three automakers, aiming to produce a prototype car by 2004 that was three times more fuel efficient than conventional vehicles,[13] achieving 75 miles per gallon with an internal combustion engine.[14] If such a prototype was ever achieved, it has not been produced and widely marketed. In 2003, President George W. Bush pledged "to promote energy independence for our country" and announced a $1.2 billion FreedomCAR proposal to develop hydrogen fueled vehicles.[15] Today, there are still no wholly hydrogen powered vehicles on the road.

Finally, the March 2006 U.S. National Security Strategy described the "petroleum curse" as the "tendency for oil revenues to foster corruption and prevent economic growth." The document claims, "In the worst cases, oil revenues fund activities that destabilize their regions or advance violent ideologies."[16] Therefore, funding of such activity is at an all time high. A barrel of oil has risen from $5.12 to (16 Oct 1973) to $78 (July 2006),[17] a 1,423% increase over three decades.

Despite the dramatic rise in oil price, it has not provided sufficient incentive to meet thirty years' of U.S. energy goals. American policy has failed to reduce dependence on foreign oil because consumers still see oil as a "good deal" in the short term. Oil has thus far had the advantage of high energy density, ease of production, and relatively low cost compared to other energy sources. This consumer preference for oil is best quantified by the declining energy intensity index—the energy use per dollar of gross domestic product (GDP) produced. Energy intensity has fallen by 70 percent from its 1920 levels. In 2001, the energy intensity index was only 56 percent of what it was in 1970.[18] Efficiency improvements in manufacturing and new oil recovery technologies have reduced the energy required to create profits for the American economy. The declining energy intensity index is a major reason for the U.S. failure to meet energy policy goals. Some argue that for Americans, energy is actually under priced, not accounting for greenhouse gas pollution costs, and therefore, sustaining excessive

consumption. The favorable economics of an oil based economy have, thus far, dampened incentives for meeting energy goals and delayed the urgency of preventing an energy crisis. However, reliance on a sustained reduction in energy intensity is not a good long term policy. Oil is a limited resource produced in politically unstable parts of the world. The National Security Strategy states, "Only a small number of countries make major contributions to the world's oil supply. The world's dependence on these few suppliers is neither responsible nor sustainable over the long term."[19] Energy security policy must change, but change is difficult for an oil based economy like the United States.

From the moment Edwin L. Drake struck oil on August 27, 1859 near Titusville, Pennsylvania, the United States began developing an appetite for this energy source.[20] Oil has become a strategically vital commodity. Access to an uninterrupted flow of oil is of critical importance to the U.S. economy. America has long known this, but done little to secure this resource. In 1946, Herbert Feis, historian, State Department advisor, and former chairman of the Committee on International Petroleum Policy, made one of the first attempts to link access to oil with strategic national interests. "Oil, enough oil, within our certain grasp seemed ardently necessary to greatness and independence in the twentieth century."[21] The only emergency plan to meet America's 20.6 million barrel per day requirement is the Strategic Petroleum Reserve with its capacity to sustain 4.4 million barrels per day for 90 days.[22] In 1943, Secretary of the Interior, Harold Ickes, made an alarming declaration in the article, "We're Running Out of Oil!" He warned leaders that if there should be a world war III, the country would have to depend on another nation's oil.[23] Not long after this, in 1948, U.S. oil imports exceeded exports for the first time.[24] Since then, history has offered many warning signs of the impact of oil addiction: the Suez Canal closure in the 1950s, OPEC's introduction of the term "oil weapon" during the 1973 Yom Kippur War and the subsequent oil embargo, the 1979 Iranian oil crisis, the security issues associated with the U.S. re-flagging of oil tankers in the 1980s, and Iraq's 1990 invasion of Kuwait.[25]

Clearly, past strategy has not achieved the goal of energy independence. The U.S. Army War College defined strategy as "the calculated relationship among ends, ways, and means."[26] In terms of the national energy strategy, there has been miscalculation for years. The "ways" and "means" used have rarely lead to the desired end goals. Better policy must begin with a thorough understanding of the problem, beginning with energy trends.

Energy Trends—Supply and Demand

Considerable debate continues about when energy supplies will peak and the world will run out of oil. Oil salesmen, like Abdallah S. Jum'ah, chief executive of the Saudi Arabian state-owned Saudi Aramco, claim that world oil supply is plentiful. As leader of the world's largest oil producing company, he argued during a September 2006 speech in Vienna, that the world has more than a century's worth of oil left at current production rates.[27] Jum'ah claimed that only 1 trillion barrels have been produced from the earth's potential of 5.7 trillion barrels, enough to last 140 years. The Saudi position is understandable, because a quarter of the world's proven crude reserves, they have an interest in avoiding development of oil alternatives.

Likewise, the International Energy Agency estimates that world oil reserves are adequate to supply considerable demand growth until 2030.[28] Part of this confidence in plentiful oil stems from selective application of definitions. "Proven reserve" oil is defined as "economically recoverable under current price and cost conditions." Therefore, as oil price increases, proven reserves increase. Oil "resources" are "known amounts of material in the ground, including amounts not now economically recoverable because of cost or technology limitations."[29] An example of the latter definition is Canada's oil sands that are second in size only to Saudi Arabia's reserves. However, extracting the oil is expensive and messy.[30] Sand grains are surrounded by bitumen, a form of crude oil, which must be strip-mined, then heated to extract the crude oil. In October 2006, Royal Dutch Shell offered $6.8 billion for the outstanding shares of Shell Canada Limited to gain a greater stake in Canada's oil sands. John Hofmeister, Shell Oil Company president said that the oil sands would be a "great supply source for the United States" and that "the easy oil is running out." Canada's total current production from oil sand is about 1 million barrels a day, but could triple as more effort is made to recover the oil. ConocoPhillips Company and EnCana Corporation also announced in October 2006 that they would spend more than $10 billion to increase output from the oil sands.[31]

Estimates of supply will therefore vary as technology and the economics of oil exploitation change. Regardless of the definition used to quantify world oil, "proven reserves" or "resources," the more that oil companies spend, the more they will find…until it runs out. Oil remains a fungible asset. There is only a finite amount. The difficulty arises in predicting when the world will exhaust oil supplies. "Peak oil theory" is the effort to predict that time. Some experts in peak oil theory predict that crude oil output is about to plateau. The U.S. Geological Survey predicts the world's production rate will peak in 2040.[32]

The concept that the earth is running dry of oil will place doubt among some policy makers about crude oil's long term reliability as an energy source. Even with credible views that delay

the peak oil concern to the mid-century, the reality will provide impetus to search for oil substitutes. The concern has been significant enough for the U.S. Department of Energy to ask the National Petroleum Council, an oil and gas industry research group, to investigate peak oil claims. Their year long study will examine the different conclusions from existing studies concerning how much oil and gas remain available.[33]

Regardless of the peak oil theory, world demand continues to increase. American oil demand has risen to 20.6 million barrels per day despite conservation efforts and renewable energy sources. Even price increases have not slowed American consumption. Although prices have fallen from a nominal all-time high of $78 a barrel in July 2006, when adjusted for inflation, oil actually reached $99.21 per barrel in April 1980.[34] In addition, as Thomas Barnett explained, "Americans tend to forget that cheap oil doesn't work just for us but for people all over the planet."[35] Oil is now the world's principle source of energy providing nearly 40 percent of the global need.[36] Global demand is now clashing with America's constantly increasing oil appetite. Chinese oil demand experienced a 30 percent increase from 2004 and now registers at 6.4 million barrels a day with conservative predictions that it could double by 2020. Some of this demand growth comes from the prediction that China's 20 million cars and trucks will number 120 million by 2020.[37] India now ranks sixth among world nations in oil demand, importing 70 percent of its petroleum.[38] In the *International Energy Outlook, 2005*, the U.S. Department of Energy has predicted world energy consumption with forecasts to the year 2025. In 2025, U.S. demand is expected to reach nearly 33 million barrels per day and the emerging Asia markets, primarily China, India, and South Korea, will exceed the U.S. demand, reaching 33.6 million barrels per day.[39] The UN estimates that world population will increase from 5.9 billion in the late 1990s to 9.4 billion in 2050,[40] which will add 70 million consumers per year, roughly the population of Germany. Even if the highest fertility rates remain only in the developing world, the industrializing populations of China and India will grow, requiring more oil. Paul Roberts suggested that "oil depletion is arguably the most serious crisis to ever face industrial society."[41]

While oil demand increases, the number of oil suppliers does not. Where can more oil be found? Overseas, the Caspian Sea region and Russia have proven reserves, but access to both remains a major drawback. Oil and natural gas from the landlocked Caspian Sea must be moved by yet-to-be-built pipelines. Once pipelined to the Black Sea, it must be shipped through the narrow Bosporus and Dardanelles Straits to reach the Mediterranean Sea. Russian oil traveling north has similar obstacles in the Danish Straits connecting the Baltic Sea to the North Sea. Additionally, 95 percent of the oil produced in Russia is carried by Transneft, the oil

pipeline monopoly. The Russian government controls 75 percent of its shares, including 100 percent of the voting stock.[42] Russia has demonstrated that it is not a reliable energy supplier, even to its neighbors. In 2005, Russia cut natural gas supplies to Ukraine over a dispute. In early 2007, Russia doubled the price of natural gas sold to Belarus and cut oil exports to Europe because of a dispute over energy subsidies. The European Union is heavily dependent on Russia, importing 25 percent of its oil and 40 percent of its natural gas from Russia.[43] Oil supplied from the Caspian Sea region or Russia would hardly further American independence from foreign oil.

In searching for more domestic oil, one should appreciate the American resistance to new drilling. This resistance is understandable as a nation that consumes one-quarter of the world's oil supply while holding only three percent of the reserves is unlikely to drill its way to oil independence.[44] Opposition to the "Drain America First" approach is reasonable. Draining U.S. supplies ensures short term oil independence, but leaves the nation vulnerable in the long term.[45] However, the reluctance of Americans and their political leaders to drill for new oil in U.S. off-shore locations and the Arctic National Wildlife Refuge (ANWR) only increases American dependence on foreign oil. Exploratory gas and oil drilling in the U.S. was cut in half from 1957 to 1974.[46] In *Energy and the National Defense*, Howard Bucknell noted:

> The oil industry as a whole has apparently concluded, on the basis of drilling costs, geological data, government regulation, or all three, that oil and gas exploration potential in the United States has been tried and found wanting.[47]

As recently as October 2006, the federal government agreed to halt oil and natural gas exploration off Louisiana's coast. Governor Kathleen Blanco sued the Interior Department to block the leasing of tracts in the western Gulf of Mexico. The lease sale has been postponed until new environmental assessments are prepared and the lawsuit is resolved.[48] Because of American unwillingness to look for domestic oil, Americans must continue turning to imported oil, which increasingly comes from unstable suppliers.

According to the President's 2006 "Advanced Energy Initiative," "Oil supply disruptions pose a threat to our economy and national security, and that threat rises the more dependent we are on oil imports, particularly from less stable regions of the world."[49] Approximately 40 percent of the world's proven oil reserves lie in Middle East oil fields.[50] Additionally, Middle East oil is easy to access, produce, and transport. According to the Energy Information Administration (EIA), the cost to produce one barrel of oil in the Persian Gulf is the lowest in the world, around two dollars. The cost to increase production is also low; large tanker ships have easy port access as well.[51] About 24 percent of oil imported by the U.S. in 2001 originated from

the Middle East.[52] By 2004, half of oil imported to the U.S. came from the Organization of Petroleum Exporting Countries (OPEC), mainly Saudi Arabia, Venezuela, Nigerian, and Iraq.[53] The U.S. has little control over production or pricing of oil from those regions. In December 2006, oil ministers from OPEC met to discuss what would be the second production cut in three months.[54] The cut could amount to 500,000 barrels a day.[55] Tighter oil supplies will almost certainly drive up prices. Closer to home, increased anti-American rhetoric from Venezuelan leader, Hugo Chavez, has done little to stabilize relations with Venezuela, the third largest oil exporter to America. In late 2005, Chavez agreed to give Indian oil companies claims to 49 percent in a new Venezuela oil field, thereby demonstrating his willingness to seek markets outside the western hemisphere.[56] In early 2007, Chavez shocked economic markets by announcing plans to nationalize private companies. He pledged to accelerate his socialist revolution by nationalizing the telephone and electric utilities and exerting state control over four major oil projects that include seventeen billion dollars of foreign investment. Subsequent to Chavez's announcement, the Venezuelan stock market plunged nineteen percent, its largest loss on record. Trading was suspended on shares of the country's largest telephone company and on a large electricity supplier after shares fell thirty percent and twenty percent respectively.[57]

The trend of increasing oil imports from unstable regions has not been halted. The future result is described in the 2006 U.S. National Security Strategy: "…oil revenues fund activities that destabilize their regions or advance violent ideologies."[58] This destabilization leads to what Brian Nichiporuk called "bad demographic trends." In *Alternative Futures and Army Force Planning: Implications for the Future Era*, Nichiporuk predicted that destabilization leads to bad demographic trends which lead to further destabilization. The result could be warlordism, anarchy, mass migration, and "collapse of state structures." [59]

The economic damage from another oil crisis would be staggering. The U.S. transportation system, the largest in the world, employs one in seven Americans. Trucks move 64 percent of U.S. commercial freight and the transportation sector accounts for one in every ten dollars in the nation's Gross Domestic Product.[60] Boston University professor Robert Kaufmann argued, "Overall economic health is directly tied to energy. Almost every U.S. recession has been tied to the cost of oil."[61]

The darkest picture of world energy in short supply is far bleaker than long waiting lines at the local gas station. The depletion of oil combined with world population growth ultimately means scarce fertile land, water, and food. Widespread resource scarcity may once again drive

nation-states to value land conquest over global trading in order to secure resources. The world could return to the territorial clashes of the eighteenth and nineteenth centuries.

Recommendations

Linking energy security to national core interests is a good first step accomplished by the Bush Administration. For the U.S., grand strategic objectives are derived from four enduring core interests:

- Preserve American Security
- Bolster Economic Prosperity
- Promote a Stable International Order
- Promotion of National Values[62]

Two of these four (economics and international order) relate to energy security. However, much of President Bush's 2006 Advanced Energy Initiative is built only on increased research funding. "Since 2001, the Administration has spent nearly $10 billion to develop cleaner, cheaper, and more reliable alternative energy sources." The document goes on to promise "…a 22% increase in funding for clean-energy technology research."[63] Research is important and will yield breakthroughs in technology, but it is time to legislate the use of existing technologies and provide large tax incentives to encourage use of emerging technologies. Americans will not change their transportation patterns because of research funding or presidential policy. The U.S. government should pursue a three-pronged approach to energy security policy for 2025. The U.S. should:

1. Mandate conservation wherever possible
2. Develop advanced energy concepts that implement technologies from sustainable resources
3. Legislate tax incentives, loan guarantees, and subsidies for those who utilize renewable energy

1. Mandate Conservation

The Bush plan to raise the fuel economy standards for SUVs from 20.7 miles per gallon (mpg) to 22.2 mpg[64] is little gain and will not force auto makers to build radically more efficient vehicles. The standard for passenger cars has been constant at 27.5 mpg since 1990.[65] Standards of 40 mpg or higher would be better. More efficient vehicles are required just to offset the growing oil demand for transportation. In the late 1970s, 50 percent of total petroleum consumption occurred in the transportation market.[66] Today, two-thirds of U.S. petroleum is

consumed by the transportation sector.[67] The conservation potential of improved auto efficiency is tremendous.

In terms of residential energy use, mandated efficiency standards are required. Under the current energy bill, 14 large appliances now must meet energy efficiency standards. This is the first time such standards have been legislated.[68] More appliances should be included under these standards. Additionally, efficiency standards must provide meaningful conservation gains. The Department of Energy (DOE) is charged with reviewing efficiency of commercial and residential appliances under the Energy Policy and Conservation Act. The DOE standard for home gas furnaces increased almost imperceptibly from the 1989 standard of 78 percent to only 80 percent this year. The agency rejected an option to raise the standard to 90 percent, meaning that the furnace turns 90 percent of the fuel into heat.[69] Even parts of the home heating industry supported higher efficiency standards. Some furnace makers (Trane, Carrier, and Lennox) already sell products that are more than 90 percent efficient. Industry teamed with energy groups on a plan to increase gas furnace efficiency, eliminate pilot lights, and install a reset mechanism that automatically adjusts to the outside air temperature. The DOE rejected the plan as well as that of regional standards that would make the highest efficiency ratings applicable only to the coldest states. In the case of furnaces and boilers, the DOE notice of rulemaking came in July 2004 with expected completion in 2007. However, the implementation date will not become effective until January 1, 2015. With 3.5 million gas furnaces and 300,000 residential boilers sold last year,[70] a substantial conservation opportunity is lost with efficiency standards that are too little and possibly too late.

Despite the lack of aggressive DOE conservation standards, one federal agency, the Department of Defense, (DOD) has had some conservation success. The Energy Policy and Conservation Act of 1975 required federal agencies to reduce energy consumption by 20 percent by 1985. The DOD has decreased energy use by 28.3 percent in standard buildings from a 1985 baseline and by 21.6 percent in industrial buildings from a 1990 baseline. These laudable savings were derived by implementing a variety of efficiency and conservation measures. Three U.S. Navy installations were honored with Presidential Awards for Leadership in Federal Energy Management in 2005. The three combined to save three million dollars in energy costs with solar-powered light-emitting diode lighting, energy leak identification and repair in facilities, and efficiencies in new construction. The U.S. Army has saved nearly eight million dollars annually at Fort Knox primarily through the use of geothermal heat pumps that replaced inefficient heating and cooling systems. Circulating water in vertical heat-exchange wells use the earth's temperature to heat and cool facilities without emitting greenhouse

gases.[71] The Energy Policy Act of 2005, requires all federal agencies to achieve a 2 percent per year reduction in facility energy use from a 2003 baseline. The DOD spends $2.9 billion per year on facility energy consumption, making it the largest single energy consumer in the nation, representing 78 percent of the federal sector. By 2025, the department plans to have 25 percent of all facility electricity consumed from renewable energy sources. Renewable energy generation projects include wind, solar, geothermal, biomass and hydrogen fuel cells. Since 1990, the DOD has sourced 8.8 percent of energy required for facilities from renewable sources.[72] The DOD provides an aggressive conservation and renewable energy example for states and municipalities to follow.

2. Develop advanced energy concepts that implement technologies from sustainable resources

Americans will not one day awake to news headlines that the world has suddenly run out of oil. They will, however, run out of inexpensive oil. Therefore, it is imperative that advanced technology development start now because no one knows exactly when "inexpensive" oil will run out. The President's budget plan to increase advanced battery research to $31 million in 2007 is welcomed. Lithium-ion batteries, similar to those in cell phones, must be improved and adapted for vehicle use. True hybrid-electric or "plug-in hybrid" vehicles will then be possible and will significantly reduce oil consumption. Unlike current hybrid vehicles that use only the gas engine to charge the on-board battery, plug-in hybrids can be plugged into a household electrical outlet and recharged overnight when power demands are low and electric utility providers have spare generating capacity. The vehicle is purely electric, with no exhaust emissions, for about 40 miles. Beyond that, the vehicle drives like a regular hybrid where the gasoline engine begins to run. Fuel economy of a plug-in hybrid could exceed 80 mpg.[73] With fossil fuels accounting for 80 percent of energy used in transportation,[74] the gasoline savings would be immense, and have the added benefit of decreasing pollution.

Closely following hybrid and electric car development must be hydrogen vehicles. The promise of hydrogen technology is too great to ignore. In his 1874 novel, *The Mysterious Island*, Jules Verne described a world in which water (composed of hydrogen) became an energy source. He called it "the coal of the future."[75] The DOE estimates that if hydrogen reaches its full potential, the FreedomCAR program could reduce oil demand by 11 million barrels per day—about the same amount imported today by the U.S.[76]

Hydrogen, the simplest, lightest, and most abundant element in the universe, is chemically bound in water, existing as two atoms of hydrogen with one atom of oxygen. The energy needed to liberate hydrogen gas can be obtained from fossil, nuclear, and renewable energy

resources.[77] Hydrogen gas is used in the fuel-cell to produce water, heat, and electricity.[78] Because of its low density, hydrogen gas is expensive to transport and pipeline. Advances in materials science must be made in order to produce, store, and distribute hydrogen at high pressures. However, once achieved, hydrogen fuel-cells will not only power vehicles, but hydrogen will be generated on site to power homes.[79] In 1999, Iceland announced its intention to become the world's first hydrogen society. Iceland has good reason to develop alternative energy sources. Iceland spent 25 percent of its trade deficit, $185 million, on oil imports in 2000.[80] Iceland provides an example of how government direction can start a nation on the path to a hydrogen economy. A hydrogen economy is the way of the future, but it will not be achieved with the Bush plan that does not expect hydrogen fuel-cell vehicles until 2020. The $1.2 billion for the President's Hydrogen Fuel Initiative[81] should be doubled to accelerate the development of practical, cost effective, clean, hydrogen fuel-cell vehicles for large numbers of Americans.

Electric and hydrogen fuel-cell vehicles are essential to energy security. The individual mobility provided by American vehicles for most of the last century permitted freedom of movement and choice that impacts all aspects of life. Americans will be unwilling to forego that level of individual freedom. In order to buy the time necessary to research, engineer, and implement preferred technologies like plug-in hybrid vehicles and hydrogen fuel-cells, America should continue the use of coal for electric power generation. The U.S. holds more than one quarter of the world's coal reserves. The energy content of U.S. coal exceeds that of the world's recoverable oil.[82] Based on U.S. Geological Survey and Bureau of Mines estimates, about 1.9 trillion barrels of oil equivalent are domestically available. At a consumption rate of 650 million short tons of coal production, "we theoretically have over six centuries worth of more or less easily recoverable coal."[83] However, more should be invested in "clean coal technologies." An array of new technologies allows the use of coal to generate electricity while meeting environmental regulations. A number of clean coal technologies have been demonstrated in recent years: Pressurized Fluidized Bed Combustion (PFBC),[84] Integrated Gasification Combined Cycle (IGCC),[85] and the Liquid-Phase Methanol Process (LPMEOH).[86] Each is designed to reduce toxic emissions. Future generation coal power plants can be nearly emission free by capturing and storing pollutants rather than releasing them into the environment. However, the FutureGen initiative, a public-private sector partnership to develop emission free technologies, received only $54 million in the President's 2007 budget.[87]

The use of coal as an interim energy source is a realistic measure while renewable energy sources are developed. This position is unpopular with some environmental groups.

Unfortunately, the issue may reduce to either using energy resources at home or launching wars for energy resources abroad. Additionally, coal use will reduce pressure on natural gas supplies. Eighty-five percent of U.S. natural gas demand is met through domestic production. Natural gas consumption has increased as it has become the "fuel of choice" for new natural gas combined-cycle power plants. The price has increased from $2 per thousand cubic feet in 1994 to $10.50 per thousand cubic feet in 2000. Although prices have declined slightly since then, the tight balance between supply and demand has led to a volatile market which responds to weather and geopolitical events.[88]

The development of advanced energy concepts is not popular in a competitive energy market. With cheap oil, there is little incentive to develop alternate fuels. As oil prices increase, the incentive grows. However, expensive oil also makes economically dry oil fields become more economically viable. Government must stimulate research and development quickly with long term vision and funding to implement new technologies to mitigate our energy risks.

3. Legislate Tax Incentives, Loans, and Subsidies

Dozens of nations have approved subsidies, tax breaks, and other incentives to promote use of renewable energy sources to reduce dependence on heavily polluting fossil fuels.[89] Although solar power accounts for less than 0.1 percent of the world's electricity supply the U.S. should subsidize its wider implementation. The U.S. should look to Asia where prospects for clean renewable solar power may be strongest. Asia is rapidly becoming a production hub for photovoltaic cells which turn sunlight into electricity. Some Asian nations can combine high-tech manufacturing expertise with low production costs to meet growing energy demands.[90] A $3,400 tax incentive for each hybrid fuel and clean diesel burning vehicle is not enough. A higher tax break will move more consumers toward hybrid vehicles and reduce demand for crude oil in the near term. Only 200,000 hybrid vehicles were sold in 2005.

More "E85" (85% ethanol) fueling stations are needed. Only 556 public stations exist today. A tax credit of more than 30% for installation of each alternative fuel station would be sufficient. With more distribution points, the production of ethanol will increase from the 3.4 billion gallons in 2004, which only accounted for 2 percent by volume of all gas sold in the U.S.[91] The next logical step beyond ethanol is cellulosic ethanol. Virtually all domestically produced ethanol comes from corn, but advanced technologies will enable the breakdown of cellulosic materials into sugars for fermentation into fuel ethanol. Agricultural and forestry residues, municipal solid waste, trees, and grasses could be used. The Department of Energy and the

U.S. Department of Agriculture study suggested that biofuels could supply 60 billion gallons of fuel per year—30 percent of current U.S. gasoline consumption.[92]

Tax breaks are one method of incentive, but taxing is another. Oil should be taxed more heavily, so consumers conserve and producers develop technologies and markets for oil alternatives. The revenue could be invested in the research and development necessary to bring new technologies to the marketplace. Legislation bringing new technologies to a level economic playing field for consumers will enable market forces to favor efficient and renewable energy. Legislation is required because an energy conversion from an oil based economy will bring problems that must be solved more quickly than the challenges of implementing conservation or finding more of the same type of energy. Howard Bucknell wrote:

> Those earlier transitions in our national energy base were accomplished at a leisurely pace allowing ample time for societal adaptation and the evolution of technologies and supporting infrastructure appropriate to our desires…Our next energy transition must be the acute and direct concern of government.[93]

President Nixon pledged, "Americans will not have to rely on any source of energy beyond our own" and President Bush hopes "to promote energy independence for our country." These lofty and thus far, unachieved goals, may also be unrealistically isolationistic. Eliminating the U.S. from global energy commodity trade may not be completely desirable. Richard Rosecrance believes "there is reason for dependence on the energy supplies of other nations."[94] He argues that "vulnerability interdependence" is an important aspect of trade between industrialized countries. This economic substructure of international relations can retard conflicts between nation-states.[95] Achieving measurable conservation and technology advances along with financial incentives to promote renewable energy use are far more achievable and internationally palatable than striving to withdraw completely from the global oil market. A balanced approach combining all three recommendations is required.

Conclusion

The more energy the U.S. uses, the less there remains for others. With only 6 percent of world population, but 30 percent of world oil consumption,[96] the voracious U.S. demand for oil will only continue to marginalize America from the world community. Launching periodic U.S. military interventions to satisfy an oil appetite may become the accepted, but very dangerous norm. Stability in the world's largest oil producing region, the Middle East is questionable. More than 34,000 Iraqi civilians died violently last year [97] and 400,000 have been forced to relocate from the instability of violence.[98] The more oil Americans use, the less time remains to survive on an oil based economy and the less time available to transition to radically new energy

systems. Lengthy research efforts alone will not achieve energy security. Tax incentives to bring new technology to market and mandatory energy efficiency standards for autos, homes, and appliances should be legislated.

As he signed the Energy Policy Act into law, President Bush declared that "…one day all Americans will look back on this bill as a vital step toward a more secure and more prosperous nation that is less dependent on foreign sources of energy."[99] Unfortunately, America has a 30 year history of unfulfilled presidential aspirations for energy independence. There is little reason to expect significant progress with current energy policy. If Einstein was correct in that "No problem was ever solved by the same consciousness that created it," drastically new energy policy is required to change the "consciousness" that brought America its oil addiction.

Endnotes

[1] Michael Moncur's Quotations available at quotationspage.com/quote/23588.html, Internet, accessed September 21, 2006. Alice Calaprice, ed., *The Quotable Einstein* (Princeton, N.J.: Princeton University Press, 1996), 23.

[2] George W. Bush, "State of the Union Address," January 31, 2006 available from http://www.whitehouse.gov/news/releases/2006/01/20060131-10.html; Internet; accessed August 18, 2006.

[3] The Arab oil embargo consisted, at least in part, of the October 16, 1973 unilateral oil price increase of 70 percent by the Organization of Petroleum Exporting Countries (OPEC), their production cutback, and their October 20, 1973 announcement to embargo all oil exports to the United States and the Netherlands.

[4] Richard M. Nixon, "Address to the Nation About National Energy Policy," November 25, 1973, available from http://www.nixonfoundatoin.org/clientuploads/directory/ archive/1973pdf_files/1973_0339.pdf; Internet; accessed 18 August 2006.

[5] Richard Rosecrance, *The Rise of the Trading State: Commerce and Conquest in the Modern World* (New York: Basic Books, Inc., 1986), 9.

[6] Terrence R. Fehner and Jack M. Holl, *Department of Energy 1977-1994: A Summary History* (Washington, D.C.: Department of Energy, November 1994), 19; available from whttp://www.cfo.doe.gov/me70/history/Summary_History.pdf; Internet, accessed 19 August 2006.

[7] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 3.

[8] James Carter, "Crisis of Confidence Speech," July 15, 1979, available from http://www.millercenter.virginia.edu/Scripps/diglibrary/prezspeeches/carter/jec_1979_0715.html; Internet; accessed 20 August 2006.

[9] Ronald Bailey, "Presidential Energy," *New York Times*, February 2, 2006, A10.

[10] George H. W. Bush, "State of the Union Address," January 29, 1991, available from http://www.millercenter.virginia.edu/Scripps/diglibrary/prezspeeches/ghbush/ghb_1991_0129.html; Internet; accessed 21 August 2006.

[11] Terrence R. Fehner and Jack M. Holl, *Department of Energy 1977-1994: A Summary History* (Washington, D.C.: Department of Energy, November 1994), 80; available from http://www.cfo.doe.gov/me70/history/Summary_History.pdf; Internet; accessed 19 August 2006.

[12] Ronald Bailey, "Presidential Energy," *New York Times*, February 2, 2006, A10.

[13] Terrence R. Fehner and Jack M. Holl, *Department of Energy 1977-1994: A Summary History* (Washington, D.C.: Department of Energy, November 1994), 80; available from http://www.cfo.doe.gov/me70/history/Summary_History.pdf; Internet; accessed 19 August 2006.

[14] Clinton Administration Technical Report #9, Transportation and the Economy; available from http://www.ibiblio.org/darlene/tech/report9.html; Internet; accessed December 7, 2006.

[15] George H. W. Bush, "State of the Union Address," January 29, 1991, available from http://www.millercenter.virginia.edu/Scripps/diglibrary/prezspeeches/ghbush/ghb_1991_0129.html; Internet; accessed August 21, 2006.

[16] George W. Bush, *The National Security Strategy of the United States of America* (The White House: March 16, 2006), 29.

[17] Bhushan Bahree and Jeffrey Ball, "Producers Move to Debunk Gloomy 'Peak Oil' Forecasts," *The Wall Street Journal*, September 14, 2006, A2.

[18] Dick Cheney, *National Energy Policy: Peport of the National Energy Policy Development Group* (Washington, D.C.: U.S. Government Printing Office, May 2001, 4.

[19] George W. Bush, *The National Security Strategy of the United States of America*, (The White House: March 16, 2006), 29.

[20] Daniel Yergin, *The Prize: the epic quest for oil, money, and power* (New York: Free Press, 2003), 26.

[21] Michael B. Stoff, *Oil, War, and American Security: the search for a national policy on foreign oil, 1941-1947* (New Haven, Connecticut: Yale University Press, 1980), 1.

[22] Spencer Abraham, *The Department of Energy's 2003 Strategic Plan* (Washington, D.C.: Office of Management, Budget and Evaluation, September 30, 2003), 22.

[23] Daniel Yergin, *The Prize: the epic quest for oil, money, and power* (New York: Free Press, 2003), 395.

[24] Daniel Yergin, *The Prize: the epic quest for oil, money, and power* (New York: Free Press, 2003), 410.

[25] George Horwich and Edward J. Mitchell, *Policies for Coping with Oil Supply Disruptions* (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1982), 3.

[26] George E. Teague, Course Director, Course Overview in "National Security Policy and Strategy Course Directive," 19 Oct-4 Dec 06, U.S. Army War College, Carlisle Barracks, PA.

[27] Bhushan Bahree and Jeffrey Ball, "Producers Move to Debunk Gloomy 'Peak Oil' Forecasts," *The Wall Street Journal*, September 14, 2006, A2.

[28] U.S. Energy Information Administration, *International Energy Outlook 2006* (Washington, D.C.: U.S. Government Printing Office), 7, available at *http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2006).pdf*, Internet, accessed October 21, 2006.

[29] *A Call For Action: U.S. Energy Independence by 1985* (Milwaukee, WI: Bucyrus-Erie Co., 1974), 5.

[30] Steven Mufson, "Oil Sands Are a Hot Commodity," *The Washington Post*, October 24, 2006, D5.

[31] Steven Mufson, "Oil Sands Are a Hot Commodity," *The Washington Post*, October 24, 2006, D5.

[32] Tim Appenzeller, "The End of Cheap Oil," *National Geographic*, June 2004, 89.

[33] Bhushan Bahree and Jeffrey Ball, "Producers Move to Debunk Gloomy 'Peak Oil' Forecasts," *The Wall Street Journal*, September 14, 2006, A2.

[34] Bhushan Bahree and Jeffrey Ball, "Producers Move to Debunk Gloomy 'Peak Oil' Forecasts," *The Wall Street Journal*, September 14, 2006, A2

[35] Thomas P. M. Barnett, *The Pentagon's New Map: war and peace in the twenty-first century* (New York: The Berkley Publishing Group, 2004), 214.

[36] Steve Yetiv, *Crude Awakenings: Global Oil Security and American Foreign Policy* (Ithaca, New York: Cornell University Press, 2004), 1.

[37] U.S.-China Economic and Security Review Commission, *2005 Report to Congress* (Washington, D.C.: U.S. Government Printing Office, November 2005), 12.

[38] Primit Mitra, "Indian Deplomacy Energized by Search for Oil," YaleGlobal Online, March 14, 2005, available from http://www.yaleglobal.yale.edu/display.article?id=5419; Internet; accessed 1 November 2006.

[39] U.S. Energy Information Administration, International *Energy Outlook 2005* (Washington, D.C.: U.S. Government Printing Office, July 2005), 77.

[40] United Nations Population Division, *World Population Prospects: The 1996 Revision* (New York: United Nations, 1996), 3-5.

[41] Paul Roberts, *The End of Oil: On the Edge of a Perilous New World* (Boston: Houghton Mifflin, 2004), 46.

[42] Russian Gazette and Russian News and Information Agency, "Transneft Branches Out," *The Washington Post*, December 13, 2006, H1.

[43] Peter Finn, "Germany's Merkel Assails Russia Over Cutoff of Oil," *The Washington Post,* January 10, 2007, A9.

[44] Editorial, "Drain America First," *The New York Times,* July 25, 2006, A18.

[45] Ronald E. Minsk, "Don't Drain America First," *Blueprint Magazine,* Mar/Apr 2002, vol. 15 (Washington, D.C.); available from http://www.ndol.org/ndol_ci.cfm?contentid=250318&kaid=116&subid=155; Internet; accessed 17 January 2007.

[46] Howard Bucknell III, *Energy and the National Defense* (Lexington, Kentucky: The University Press of Kentucky, 1981) 29.

[47] Howard Bucknell III, *Energy and the National Defense* (Lexington, Kentucky: The University Press of Kentucky, 1981) 28.

[48] "Oil and Gas Exploration Halted Off La. Coast," *USA Today*, October 25, 2006, 3A.

[49] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 2.

[50] Energy Information Administration, *World Proved Reserves of Oil and Natural Gas, Most Recent Estimates* (Washington, D.C.: U.S. Government Printing Office, November 9, 2004); available from http://www/eia.doe.gov/emeu/international/reserves.html; Internet; accessed 3 November 2006. Also available from http://www.eia.doe.gov/ipm/balance.html.

[51] U.S. Energy Information Administration, *International Energy Outlook 2004* (Washington, D.C.: U.S. Government Printing Office), 38.

[52] Richard Chaney, *National Energy Policy* (Washington, D.C.: The White House, May 2001), 8-1.

[53] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 2.

[54] Bhushan Bahree, "OPEC Likely to Restrain Production," *The Wall Street Journal*, December 14, 2006, A2.

[55] Masood Farivar, "Crude-Oil Futures Rise as OPEC Mulls Output," *The Wall Street Journal*, December 14, 2006, C5.

[56] Primit Mitra, "Indian Deplomacy Energized by Search for Oil," YaleGlobal Online, March 14, 2005, available from http://www.yaleglobal.yale.edu/display.article?id=5419; Internet; accessed 1 November 2006.

[57] Juan Forero, "Chavez's Economic Plans Set Latin Markets Reeling," *The Washington Post,* January 10, 2007, A7.

[58] George W. Bush, *The National Security Strategy of the United States of America* (The White House: March 16, 2006), 29.

[59] Brian Nichiporuk, *Alternate Futures and Army Force Planning: Implications for the Future Era* (Santa Monica, CA: Rand Corp., 2005), 25.

[60] Felix Ammah-Tague, *Freight Shipments in America: Preliminary Highlights from the 2002 Commodity Flow Survey* (Washington, D.C.: U.S. Department of Transportation Bureau of Transportation Statistics, 2002), 1.

[61] Jean Hennelly Keith, "Crude Awakening," *Bostonia*, No. 4 (Winter 2005-2006), 31.

[62] J. A. Helis, Course Overview Lecture for "National Security Policy and Strategy Course, 18 October 2006, U.S. Army War College, Carlisle Barracks, PA and NSPS Course Directive, page 13.

[63] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 1.

[64] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 3.

[65] U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics 2003, BTS02-08 (Washington, D.C., U.S. Government Printing Office, March 2003), Table 1-11, available from http:www.bts.gov/publications/national _transportation_statistics/2003/Index.html; Internet; accessed 1 November 2006.

[66] U.S. Department of Energy, *National Energy Plan II (NEP II)*, 1979, III-6.

[67] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 2.

[68] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 9.

[69] Cindy Skrzycki, "An Energy Ruling That's Simply Hot Air," *The Washington Post*, October 24, 2006, D1.

[70] Cindy Skrzycki, "An Energy Ruling That's Simply Hot Air," *The Washington Post*, October 24, 2006, D12.

[71] D. K. Lynn, "Navy Rewarded for Energy Leadership," *The Military Engineer,* Jan-Feb 2007, Vol. 99, No. 645, 18 and 33.

[72] L. Eileen Erickson, Editor-In-Chief, "Leader Profile: Dr. Get W. Moy, P.E., Director, Installations Requirements and Management," *The Military Engineer*, Sept-Oct 2006, Vol.98, No. 643, 31.

[73] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 4.

[74] Martha Hostetter, editor, *The Reference Shelf*, *Energy Policy*, volume 74, Number 2 (H. W. Wilson, February 2002), 3-4.

[75] Jules Verne, *The Mysterious Island*, 1874, original edition translated by Hetzel, available from http://www.bookrags.com/ebooks/1268/3.html; Internet; accessed 3 September 2006.

[76] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 7.

[77] Peter Hoffman, *Tomorrow's Energy—Hydrogen, Fuel Cells, and the Prospects for a Cleaner Planet* (Cambridge, Massachusetts: MIT Press, 2002), 4.

[78] Seth Dunn, "Hydrogen Futures—Toward a Sustainable Energy System," Worldwatch Paper 157 (August 2001): 8.

[79] M. Conte, A. Iacobazzi, M. Ronchetti, and R. Vellone, "Hydrogen Economy for a Sustainable Development: State-of-the-Art and Technological Perspectives," Advanced Energy Technology Division, Rome, Italy, *Journal of Power Sources*, 100, (2001): 171-172.

[80] Seth Dunn, "Hydrogen Futures—Toward a Sustainable Energy System," Worldwatch Paper 157 (August 2001): 6.

[81] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 6.

[82] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 10.

[83] Howard Bucknell, III, *Energy and the National Defense* (Lexington, KY, The University Press of Kentucky, 1981), 24.

[84] 2004 National Energy Technology Laboratory, *Clean Coal Compendium*; *Tidd PFBC Demonstration Project* (January 20, 2004), 1; available from http://www.netl.gov/cctc/factsheets /tidd/ tidddemo.html; Internet; accessed 4 September 2006. Pressurized Fluidized Bed Combustion burns coal in a coal-water fuel paste. The process reduces sulfur and nitrous emissions. See also http://www.netl.doe.gov/technologies/coalpower/Combustion/FBC/fbc-overview.html.

[85] 2004 National Energy Technology Laboratory, *Clean Coal Compendium*; *Pinon Pine IGCC Power Project*, January 2004, 1; available from http://www.netl.doe.gov/cctc/ factsheets/pinon/pinondemo.html; Internet; accessed 7 September 2006. Integrated Gasification Combined Cycle (IGCC) technology produces coal gas to be burned in steam turbine generators. See also http://www.netl.doe.gov/technologies/coalpower/ gasification/pubs/pdf/18.pdf.

[86] 2004 National Energy Technology Laboratory, *Clean Coal Compendium*; *Commercial-Scale Demonstration of he Liquid-Phase Methanol (LPMEOH) process*, January 20, 2004, 1;

available from http://www.netl.doe.gov/cctc/factsheets/estm/csliquiddemo.html; Internet; accessed 7 September 2006. The LPMEOH process technology produces methanol from coal to be used as a cleaner burning fuel.

[87] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 11.

[88] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 8.

[89] Jane Spencer, "For Solar Energy Firms, Future May Be Brighter," *The Washington Post*, October 25, 2006, D5.

[90] Jane Spencer, "For Solar Energy Firms, Future May Be Brighter," *The Washington Post*, October 25, 2006, D5.

[91] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 5.

[92] George W. Bush, *Advanced Energy Initiative*, (The White House: National Economic Council, 20 February 2006), 5.

[93] Howard Bucknell, III, *Energy and the National Defense* (Lexington, KY: The University Press of Kentucky, 1981), 193.

[94] Richard Rosecrance, *The Rise of the Trading State: Commerce and Conquest in the Modern World* (New York: Basic Books, Inc., 1986), 145.

[95] Richard Rosecrance, *The Rise of the Trading State: Commerce and Conquest in the Modern World* (New York: Basic Books, Inc., 1986), 17.

[96] Howard Bucknell, III, *Energy and the National Defense* (Lexington, KY: The University Press of Kentucky, 1981), 189.

[97] Damien Cave and John O'Neil, "U.N.'s Iraqi Toll: 34,000," *The Philadelphia Enquirer*, January 17, 2007, A1.

[98] Anthony H. Cordesman, *Iraq's Sectarian and Ethnic Violence and the Evolving Insurgency: Developments through mid-December 2006*, (Washington, D.C.: Center for Strategic and International Studies, December 14, 2006), 2, available from http://www.csis.org/media/csis/pubs/120614_iraq_update.pdf; Internet; accessed 20 December 2006.

[99] Samuel W. Bodman, Secretary of Energy, *On the Road to Energy Security—Implementing a Comprehensive Strategy: A Status Report, Annual Energy Review*, posted July 27, 2006 available from http://www.energy.gov/media/Final_8-14_DOE_booklet_copy_sep.pdf; Internet; accessed 22 August 2006.